

Jute and Allied Fibres.

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ATTEMPTS have been made from a very early period to test different types of fibres allied to jute fibres and to replace jute fibres by fibres of some other species. The fibres allied to jute are well known to cultivators for some time and adulteration of jute fibres of commerce is not uncommon. Commercial people dealing in jute carry on transactions either to their advantage or disadvantage in proportion to their knowledge and experience of distinguishing the genuine fibres of jute from the rest while handling the stuff in the market. Some of the fibres are so much allied to jute fibres that it is by no means an easy task of distinguishing between two or several fibres if mixed up together. Of such fibre-yielding plants may be mentioned *Hibiscus cannabinus* Linn. (Mestapat), an annual or perennial prickly herbaceous shrub. This species is reported to grow wild, east of the Northern Ghats but generally cultivated for its fibres in Chota Nagpur, districts of Meerut, Northern Oudh and extensively cultivated in Central and Southern India. It is also reported that the plant is not uncommon in the lower Himalayas ascending up to 3,000 feet in elevation. In Dacca, East Bengal, the plant forms the chief material in the manufacture of paper. The species is a well known medicinal plant. The fibres of this species are very much allied to jute fibres, and are profusely employed in Bengal for the purposes of or as a substitute for jute in the manufacture of fishing nets and other articles of commerce.

Jute belongs to the genus *Corchorus* of the family—Tiliaceæ. There are about forty species under this genus which are distributed throughout the tropical parts of the world. Out of this total number only eight species are wild in India. Of these eight species again only two species *Corchorus capsularis* L. and *C. olitorius* L. are the chief source of the supply of fibre-jute or gunny. The jute plant is an annual, erect, tall, little-branched herbaceous shrub. The fibre is beaten out of stems after cutting and retting in water. The above two species of jute (pat) proper are grown chiefly in Northern, Central and Eastern Bengal and are not available in any other provinces of India. The place of jute fibres is generally taken in other provinces by *Cannabis sativa* (Indian Hemp fibre), *Crotalaria juncea* (Sunn-Hemp), *Hibiscus cannabinus* (Deccan or Ambori Hemp) and sometimes *Malachra capitata* (Ran or Ban-bhendi) and *Sida* sp. (Berala). There are two other *Hibiscus* species whose fibres are also closely allied to jute (1) *H. Abelmoschus* Linn. (The Musk Mallow) a bushy herb which grows during the rains and flowers in cold season, occurs throughout the warmer parts of India. (2) *H. Sabadariffa* Linn. (The Rozelle) an annual, glabrous, unarmed herb with purplish stem which is generally cultivated throughout the hotter parts of India. Adulteration of jute fibres with those of *Hibiscus* sp. or identification of one of these fibres as jute fibres appears to be of daily occurrence in commerce.

I have recently had an opportunity of examining such fibres particularly of jute and *Hibiscus* through the courtesy of Mr. M. C. Ghose, the

Chemical Examiner, Customs Department, Calcutta. I offer my best thanks to Mr. Ghose for favour of his placing the authentic materials at my disposal. I understand investigation on a sound footing is likely to be in progress in Mr. Ghose's laboratory. Due to export of various fibres and different kinds of foreign cotton and woollen goods at present pouring in Calcutta markets, the distinction of different qualities of fibres is nowadays gaining considerable state importance.

The writer realises that such an investigation can be best carried out by chemists, physical chemists and plant physiologists. He, therefore, by contributing this article, invites their suggestions for a practical, simple and speedy method of distinguishing various kinds of fibres from genuine jute fibres, and also of ascertaining comparative value of various qualities of genuine cotton and woollen goods from spurious materials. Such a discovery will undoubtedly be of considerable importance to commercial and industrial people of this country. Their work is likely to have a far-reaching value. But in the meantime it might be worth while to report here the results of my examination of jute and Mesta fibres, as also conclusions arrived at from experiments carried out on these two fibres by some of the previous workers.

Macroscopic examination shows that jute fibres are more silky to the touch, very pale brown, finer and more pliable or elastic than those of Mesta fibres which are slightly deeper brown, coarser and harsh. Both are combustible but jute appears to be quicker in catching fire and less resistant to combustion. Mesta fibres seem to support combustion to a certain extent.

Microscopic examination reveals that both fibres are bast fibres and are composed of prosenchymatous cells cohering together in bundles by dovetail arrangement. The thickness of the cell-wall varies at both the tapering acute or acuminate ends in ultimate fibre. By ultimate fibre is meant a single prosenchymatous cell of the bast fibres which might be separated out by maceration. The ultimate fibres of Mesta (*Hibiscus cannabinus*) vary from 1.5 to 4 mm. in length and 12 μ in width at the middle. They are nearly of the same length and width as those of jute, which vary from 1 to 3 mm. in length and nearly 12 μ in width. The thickness of the wall of both the fibres is 4 μ and the lumen is 4 μ broad. But roughness in Mesta fibres is evidently due to the nature of the encrusting substance lignin. Pliable more elastic composition of the cell-wall of jute fibres is due to this difference in lignification which occurs uninterruptedly over the whole area of the cell wall. The nature of impregnation of the cell-wall in jute is neither true cellulose nor true lignin. It is a compound cellulose peculiar to jute and cereal grass type and in the case of jute it is known as lignocellulose. These lignocelluloses induce formation of Prussian blue in the greenish red solution produced by mixing ferric chloride with potassium ferri-cyanide. It is on this point, I mean, the nature of lignification, that

Hibiscus cannabinus (Mesta fibre) are of less textile value. Under hydrolysis (*i.e.*, boiling in one per cent. caustic soda, Na_2O) for five minutes, Mesta fibres lost 14.0 and after continued boiling for one hour, 19.5 per cent. of its weight and that under the same treatment jute fibres lost considerably less, *viz.*, 13.3 and 18.6. But what appears to be an important point of difference is, in spite of the slight difference in weight and tension experiment (I mean here the breaking strain) what I may call the steam experiment. Samples of the fibre exposed for two hours to steam at 2 atmospheres followed by boiling in water for 3 hours and again steamed for 4 hours lost only 3.63 per cent. by weight and jute 21.39.

It is due to the nature of lignification that my experiment shows that Mesta fibres are more tough, readily absorb lignin stain than those of jute fibres. Phloroglucin with HCl might exhibit difference of brightness in red colouration

due to the depth and difference of lignification of the two fibres. Variation in moisture contents jute (10.3 per cent.) and pH (*i.e.*, acidity and alkalinity) of ash contents of the two fibres are also good differential tests.

The fibres as found in commerce are mainly bast fibres of bundles separated from the parenchymatous cortical layer. They are firmly coherent together and each bundle is composed of half a dozen to two dozens ultimate fibres which are of, as stated above, normal fusiform type. In transverse section they are thick-walled (due to encrustation of lignin) and polygonal. These allied jute fibres when treated with iodine are brown, deep yellow with aniline sulphate and jute instead of becoming bright red is purple with phloroglucin and hydrochloric acid. Concentrated solutions of alkalis have also a remarkable action on fibres of this group.

Colloidal Electrolytes.

THE study of Colloidal Electrolytes has been engaging the attention of eminent physical chemists, and has attracted considerable interest from the theoretical and technical standpoints during the last twenty years. The term "Colloidal Electrolyte" was first used by Duclaux in 1909 for the class of substances having properties common to typical colloids and electrolytes; and later on the term was applied to various systems such as soaps, dyestuffs, proteins, starches, etc. It is therefore with deep interest that workers in Colloid chemistry and allied branches of science will study the monograph published by the Faraday Society (January 1935) embodying the papers presented for the sixty-first general discussion held by the Society. The discussion was held at the University College, London, from 27th to 29th September 1934 under the presidency of Prof. F. G. Donnan, F.R.S.; and prominent Colloid Chemists from overseas attended the meeting. The subject was discussed broadly under two heads; Part I General (including theory and experimental technique) and Part II (special and technical) dealing with soaps, dyestuffs, proteins, starches and other materials.

Dr. Freundlich in the introductory paper (p. 4)* has pointed out the most significant property which distinguishes a colloidal electrolyte from an ordinary colloid. The former are characterised by the spontaneous formation of colloidal ions as contrasted with ordinary colloids where ions of an active electrolyte are present as necessary impurities. The ion micelles formed as a result of aggregation are responsible for the peculiar properties of colloidal electrolytes. (Osmotic Pressure, Conductivity, etc.) The colloidal electrolytes in general fall under three broad categories: (1) The ion micelles sensible to dilution with the formation of simple ions which can be dialysed (Soaps). (2) Ion micelles sensible to dilution with the formation of simple non-dialysable ions (Dyestuffs). (3) Colloidal electrolytes not affected by dilution (Proteins). The electrical properties of the ion micelles no doubt undergo

profound changes in presence of strongly adsorbable substances.

The electrochemistry of colloids and particularly colloidal electrolytes has been extensively worked out by Pauli and his co-workers (*Electrochemie der Kolloide*, Wein, 1929). The essential idea underlying Pauli's work is that any colloid behaves like an ordinary electrolyte in the sense that its surface is dissociated giving rise to the constituent ions of the solid phase. The so-called ionogenic complex gets fixed to the solid phase giving rise to the charge on the particle. The "gegenions" are the ions situated on the liquid side of the interface. The electrochemical properties of sols of Gold and Platinum (p. 12) have been explained on the basis of the adsorption of complex acids formed during the preparation of the sols.

The problem of deciding the exact structure of the electrical double layer surrounding the colloidal particle has been one of great difficulty. Kruyt (p. 31) maintains that while the inner layer is formed from the material of the particle itself, the outer layer contributing to the ζ potential may consist of ions from other sources as well.

The question whether lyophobic sols can be considered to be colloidal electrolytes has been discussed at great length by Rabinovitch and his co-workers (p. 50). Their views differ fundamentally from those of Pauli and his school. While Pauli and Valko (p. 20) have assumed that potentiometric methods as applied to colloidal systems give an idea of the concentration of the "gegenions". Rabinovitch maintains (p. 57) that potentiometric methods can only measure the activity of the ions in the intermicellar liquid, which is quite different from the activity of the "gegenions".

It appears to us that a satisfactory theory of the nature of the interfacial layer should take into consideration the activity of the "Charging" ions, the "gegenions", and the ions in the intermicellar liquid. The adsorbed ions contributing to the charge on the particle may be the constituent ions of the solid phase. The binding of such ions to the surface of the particle is usually strong. The "gegenions" held electrostatically by the

* References are to the pages in the *Monograph* (*Trans. Far. Soc.*, 1935, 21, 1-121).